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RESEARCH MEMORANDUM

DETERMINANTS OF DEPENDENCY RATES FOR MARINE CORPS ENLISTED PERSONNEL

Peter F. Kostiuk

9 July 1985

MEMORANDUM FOR DISTRIBUTION LIST

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Encl: (1) CRM 85-25, "Determinants of Dependency Rates for
            Marine Corps Enlisted Personnel," May 1985

    1. Enclosure (1) is forwarded as an item of possible interest.

    2. This Research Memorandum describes our analysis of the
factors that have led to recent increases in the dependency rates of
Marine Corps enlisted personnel. The report also estimates future
dependency rates.

    3. The enclosure provides further documentation of a quick
response analysis we conducted on the above issue for the Manpower
Plans and Policy Division of Headquarters, Marine Corps.

William H. Sims
Director
MCOAG Manpower and
   Training Program

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DETERMINANTS OF DEPENDENCY RATES FOR MARINE CORPS ENLISTED PERSONNEL

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ABSTRACT

This memorandum analyzes the causes of the rise in the dependency rate for Marine Corps enlisted personnel since 1980. The effect of economic and demographic factors are examined statistically, and forecasts through 1988 are provided.

EXECUTIVE SUMMARY

This memorandum examines the causes of the recent rise in the dependency rate for Marine Corps enlisted personnel. The dependency rate is the percentage of enlisted Marines having at least one dependent. Quarterly data from the beginning of FY 1977 through 1984 are used to determine how factors such as grade, age, education, and military pay influence dependency rates. The impact of Marine Corps policy changes is also investigated.

The study concludes that changes in military pay and in the age distribution of the enlisted force are the major factors causing fluctuations in dependency rates. Age is an important determinant of dependency because of its high correlation with the probability of being married. High reenlistment rates during the past few years have raised the average age within the Marine Corps. The result is more older Marines with higher rates of dependency.

Even within age groups, dependency rates have been rising. Using correlation and regression techniques, the analysis found that changes in military pay have been the main cause for variations in dependency within age groups since 1977. The high rates of dependency now prevalent are actually a return to the more typical rates characteristic of the mid-1970s. The low dependency rates of 1979 and 1980 resulted primarily from the severe erosion in military pay, which reduced the enlisted Marine's ability to marry and raise a family.

Since military pay has been constant for the past 2 years, the rise in dependency rates within age groups should now level off. However, the aggregate Marine Corps dependency rate will continue to rise during the next few years because of the continued aging of the enlisted force. If it is assumed that military pay will not change and that the average age within grades will increase at the rate of the last 2 years, dependency rates are predicted to rise in grades E-3, E-4, and E-5. Predicted dependency rates for 1986 to 1988 by pay grade are provided in table I. It is also assumed that aging of the force will level out in 1988.

If either military pay or reenlistment rates change significantly, the predictions in table I must be adjusted accordingly.

TABLE I

PREDICTED DEPENDENCY RATES FOR 1986-1988
BY PAY GRADE
(percent)

Pay grade	1985[a] dependency rate	Predicted dependency rate		
		1986	1987	1988
E-1	6.8	6.8	6.8	6.8
E-2	12.4	12.4	12.4	12.4
E-3	23.7	24.3	24.9	24.9
E-4	41.8	43.8	45.8	45.8
E-5	69.0	70.9	72.7	72.7
E-6	88.1	88.1	88.1	88.1
E-7	94.8	94.8	94.8	94.8
E-8	97.1	97.1	97.1	97.1
E-9	97.1	97.1	97.1	97.1

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a. Actual dependency rate for December 1984.

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INTRODUCTION

In recent years, the Marine Corps has experienced a significant rise in the number of enlisted Marines with dependents. Figure 1 shows the percentage of Marines with dependents (the dependency rate) from 1977 to 1985. Of particular interest is the distinct U-shape of the graph, with the lowest rate of dependency occurring in 1980. Since that time, the rate has risen steadily, with recent rates exceeding those for 1977.
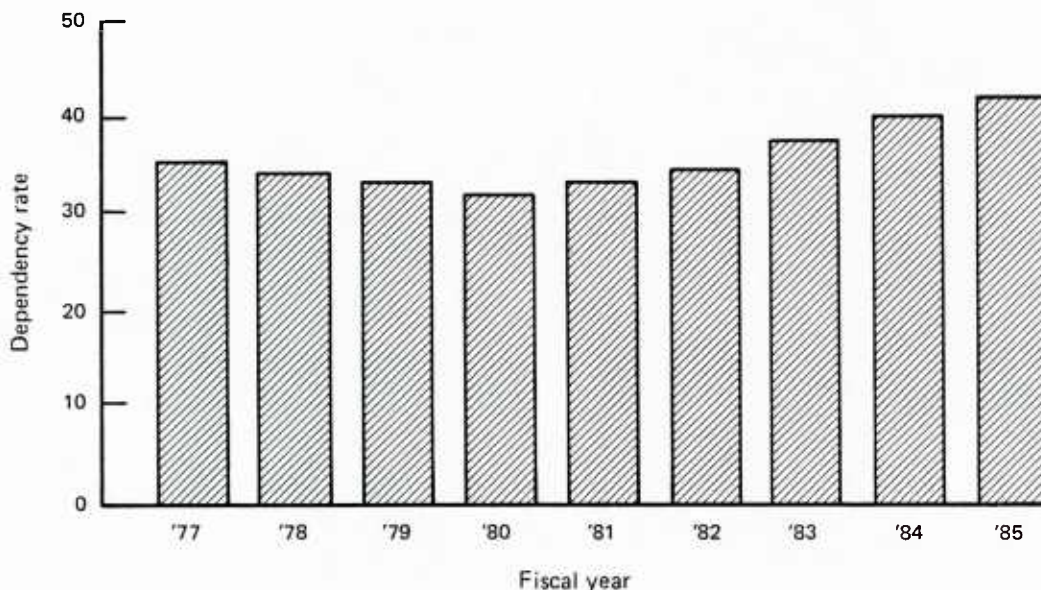
FIG. 1: DEPENDENCY RATES FOR ENLISTED MARINES, 1977-1985

The aggregate Marine Corps dependency rates shown in figure 1 obscure the underlying factors that influence the level of dependency. Changes in the age distribution of enlisted Marines, for example, have an important effect on the aggregate dependency rate, because older Marines are more likely to be married. Moreover, high reenlistment rates result in a higher grade structure, which, in turn, can increase dependency rates.

Two additional types of factors that may have affected enlisted dependency rates are demographic trends and Marine Corps policy changes. If overall marriage rates are rising in the United States, it is likely that the pattern for Marines is similar. Recent policy changes, such as those implemented in

the Unit Deployment Program (UDP), may have made family life more attractive for Marines by reducing both uncertainty and time spent overseas. Combined with additional on-base housing overseas, such policies may have made marriage more desirable for Marines by increasing the stability of family life.

Each of the factors mentioned above could have contributed to the rise in Marine dependency rates. This analysis will address each in turn and determine the degree of influence on the aggregate dependency rate; other possible explanations will also be examined.

SOURCES OF CHANGES IN DEPENDENCY RATE

The dependency rate is actually made up of several components, each of which has its own set of determining factors. The first goal of the analysis was to determine which components are most responsible for the rise in the rate. For this study, dependency was divided into three categories or types of dependent: The first, and most important, is the presence of a spouse, which is determined by whether or not the Marine is married. The second category is presence of a child but no spouse, and the final category is presence of a dependent parent. The relative importance of the three components of the aggregate Marine Corps dependency rate since 1977 is shown in table 1.

TABLE 1

COMPONENTS OF DEPENDENCY RATE
(percent)

Fiscal year	Child	Parent	Spouse	Dependency rate
1977	1.6	0.2	33.4	35.2
1978	1.8	0.2	31.9	33.8
1979	1.9	0.2	30.8	32.8
1980	2.0	0.1	29.9	32.1
1981	2.2	0.1	30.1	32.5
1982	2.5	0.2	31.7	34.3
1983	2.6	0.2	34.7	37.4
1984	2.6	0.2	37.3	40.1
1985	2.6	0.2	38.4	41.3

Clearly, marital status (or spouse) is by far the largest component of the dependency rate. More importantly, fluctuations in the "spouse rate" most clearly resemble those in the aggregate dependency rate. The rise in the rate for children has been steady, so that the distribution curve does not exhibit the U-shape that is characteristic of the total dependency rate. The fluctuation in the rate for dependent parents is far too small to have a significant impact.

These observations are confirmed statistically: The correlation between marital status and the aggregate dependency rate is high – 0.96. The correlation between the dependency rate and the rates for dependent child and parent are, respectively, 0.03 and 0.19. The following analysis, therefore, concentrates on marital status as the most important factor influencing the aggregate dependency rate.

Part of the rise in dependency – about 25 percent – can be attributed to the higher grade structure. There are lower percentages of Marines in grades E-1 and E-2, with correspondingly higher proportions in grades E-3 and E-4. However, because there is also a rising trend within grades through the 1980s, at least one other factor must be operating.

Figure 2 demonstrates a common pattern in dependency rates for all pay grades. The distribution over time for each grade is U-shaped, with the lowest rates occurring during 1980. Rates in the last 2 years are slightly higher than in 1977. The shapes of the curves bring up an interesting question: Which rates are unusual – the relatively high dependency rates of the last few years or the low rates from 1979 to 1981? That rates are higher now than ever before might indicate that these rates reflect some new trend, but, in fact, figure 2 is misleading. The aging of the force in recent years has created not only a higher grade structure but also a higher average age within grades. Figure 3 shows dependency rates for enlisted Marines by age group. The curves demonstrate the familiar U-shape, and current rates are lower than in 1977.

It can be concluded, therefore, that the changes in the pay grade and the age structure of the enlisted force are two reasons for the higher dependency rates. That these two factors cannot explain all of the increase is clear, since there are still variations in dependency for both groups, as shown in figures 2 and 3. However, age alone accounts for 65 percent of the rise in the aggregate dependency rate since 1980. The remaining 35 percent remains to be explained.
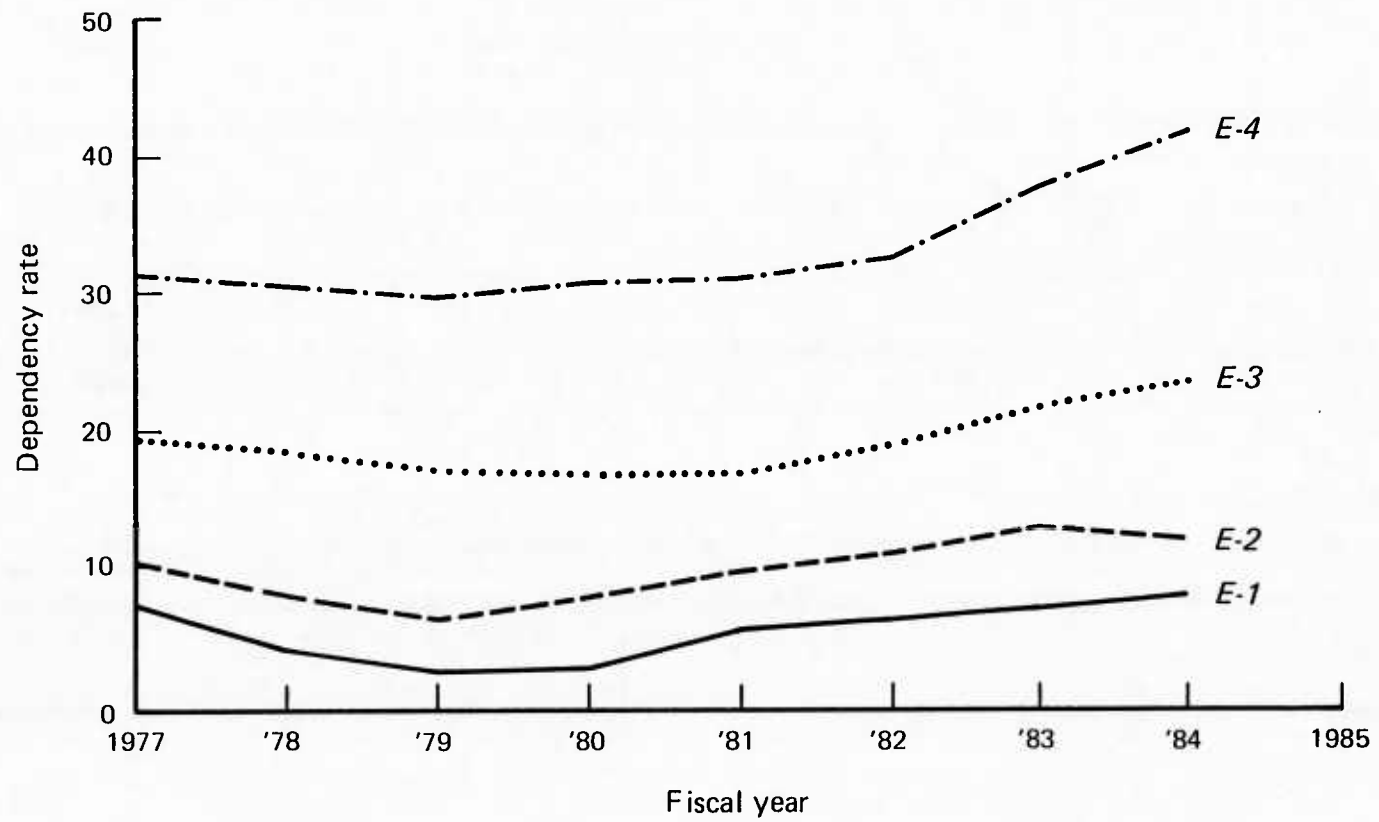
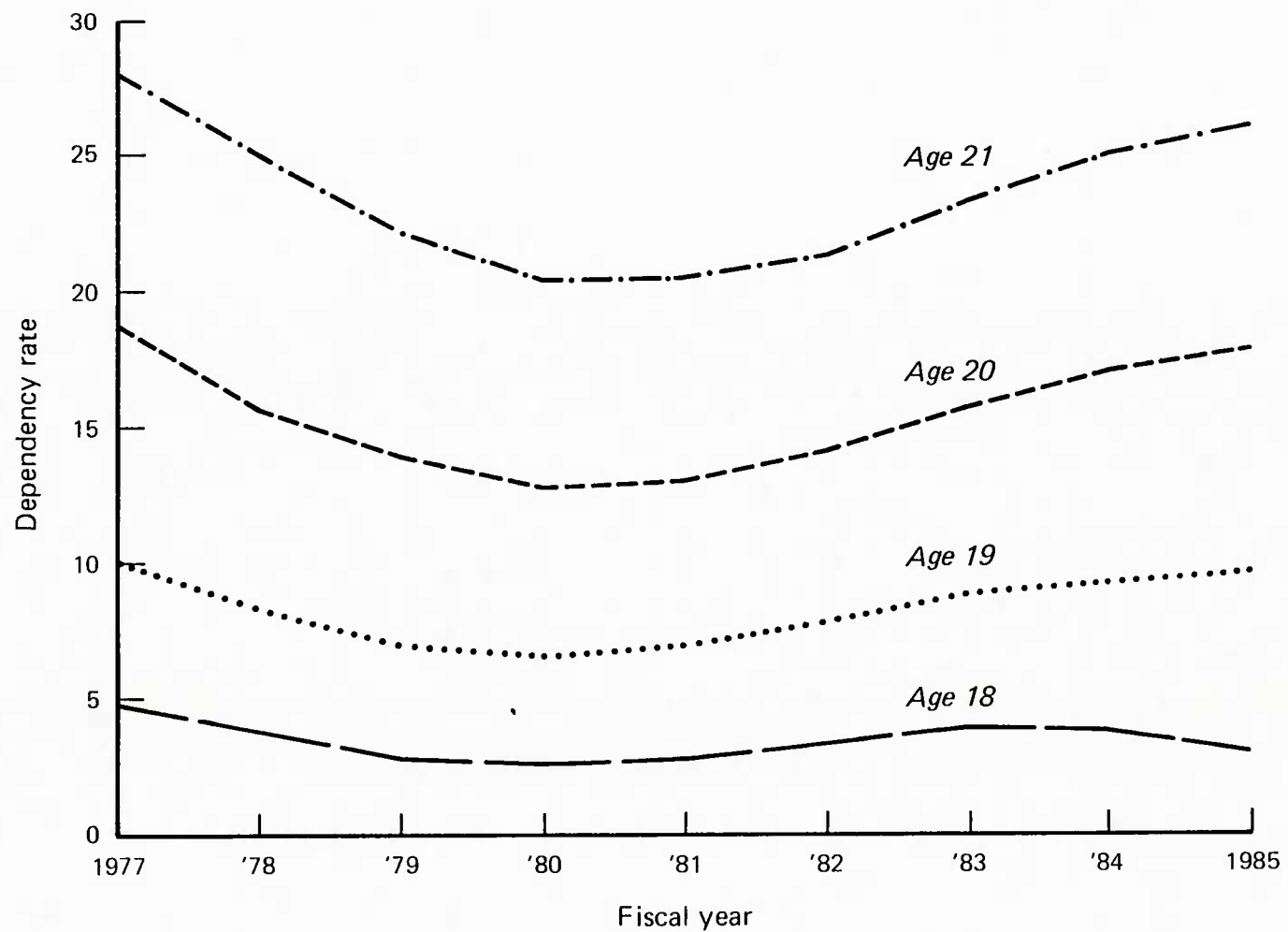**FIG. 2: DEPENDENCY RATES FOR ENLISTED MARINES BY PAY GRADE**

FIG. 3: DEPENDENCY RATES FOR ENLISTED MARINES BY AGE

Comparing dependency rates for Marines to those for civilians and other service forces will shed light on whether some other factors proposed as explanatory are, in fact, determining factors. One reason proposed for the rise in dependency is demographic – that is, it is said that more people are getting married now than were several years ago. If this were true, civilian marriage rates could be a good indicator of Marine dependency rates. However, as shown in figure 4, civilian marriage rates have declined steadily in every age group since the early 1970s. Marriage rates for Marines are somewhat different; figure 5 shows a direct comparison of the two populations.

One possible reason for the steady decline in the civilian marriage rate is the changing character of the population. The proportion of high school graduates in the 18-to-24 age group has climbed steadily since 1970. Since marriage rates tend to decline with education, the proportion married in a population with increasing education will decline, even if the underlying component averages remain unchanged. That is, the overall trend may fall even though the marriage rates for different educational levels are unchanged, due to shifts in the educational status of the population. More data on the civilian population are required to determine whether changing educational levels explain the decline in civilian marriage rates. Until more detailed data are available, it is not possible to reach a definitive conclusion about the apparent difference between Marine and civilian marriage rates.

In figures 6 and 7, Marine dependency rates are compared to Navy rates for the period 1977 to 1984. The overall patterns for both services are similar, and the rates for grades E-3 and E-4 (figure 7) have moved closer together in recent years. The similarity in patterns between the Marine and Navy rates suggests that the same factors are influencing both groups. Thus, Marine policy changes (such as implementation of the Unit Deployment Program) can be eliminated as a major factor in the movement of dependency rates. This is not to say that implementation of these programs has had no impact, but only that the effects are small and cannot explain much of the 9-point rise since 1980. Moreover, programs that started in the late 1970s cannot have been a factor in the initial high rates of dependency during the first few years the programs were in effect. Another explanation must be found.

The single variable that is most closely correlated with dependency rates is military pay. In figure 8, an index of military pay and allowances is superimposed on dependency rates for enlisted Marines ages 18 to 21. Although the correlation is not perfect, the general U-shape of the curve for pay is similar to the curve for dependency. Of course, other variables charted over a similar
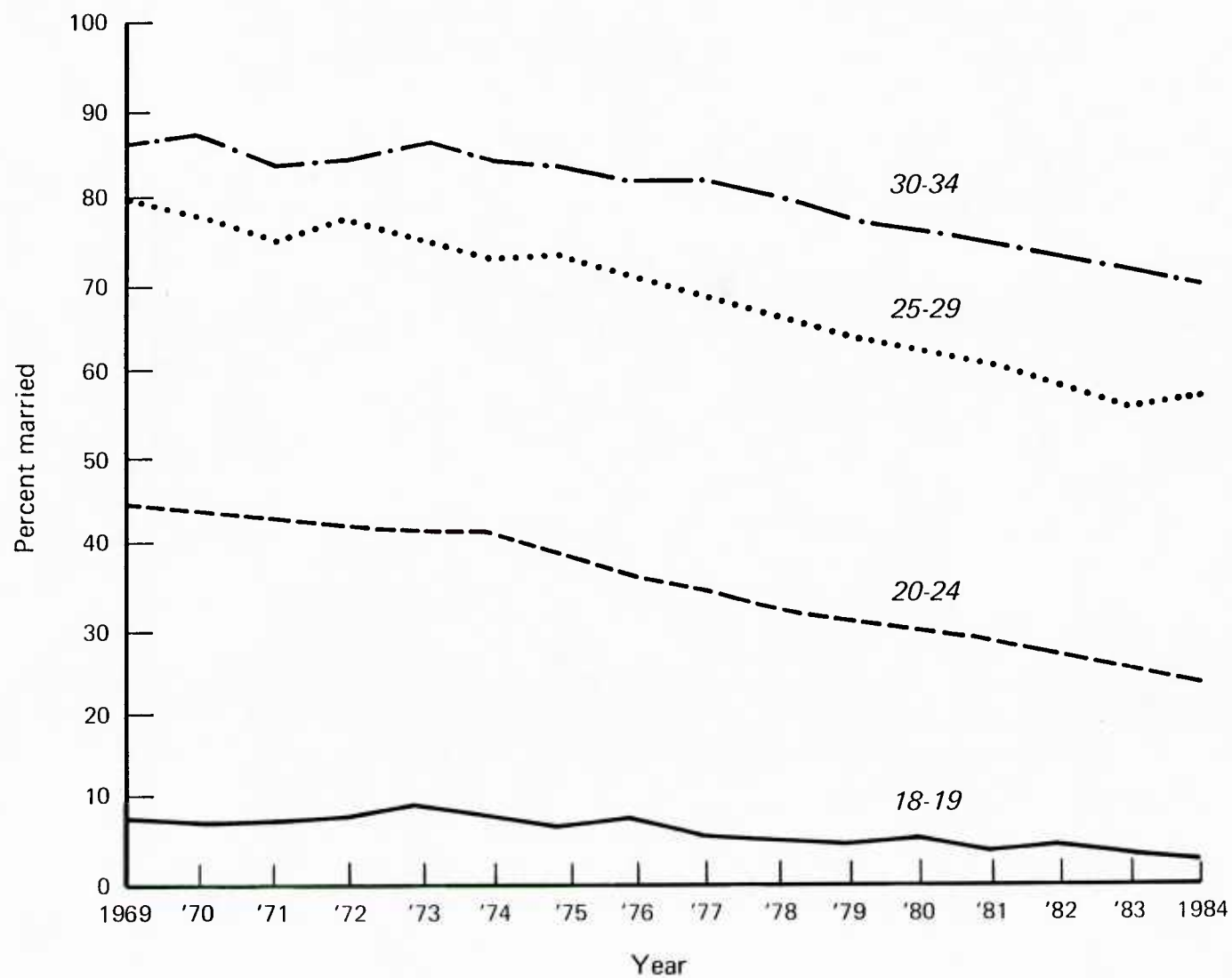
FIG. 4: MARRIAGE RATES FOR MALE CIVILIANS BY AGE GROUP, 1969-1984
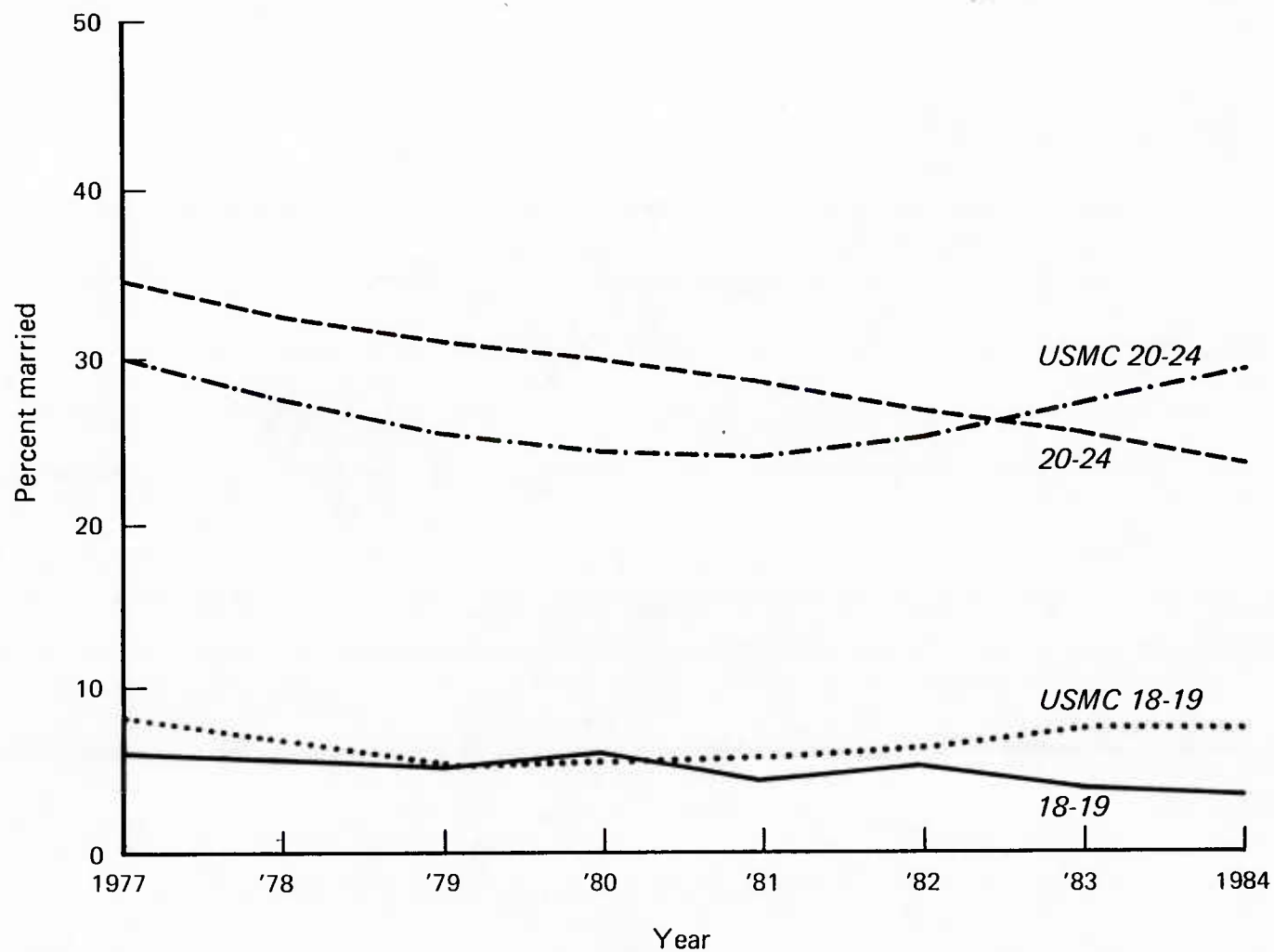
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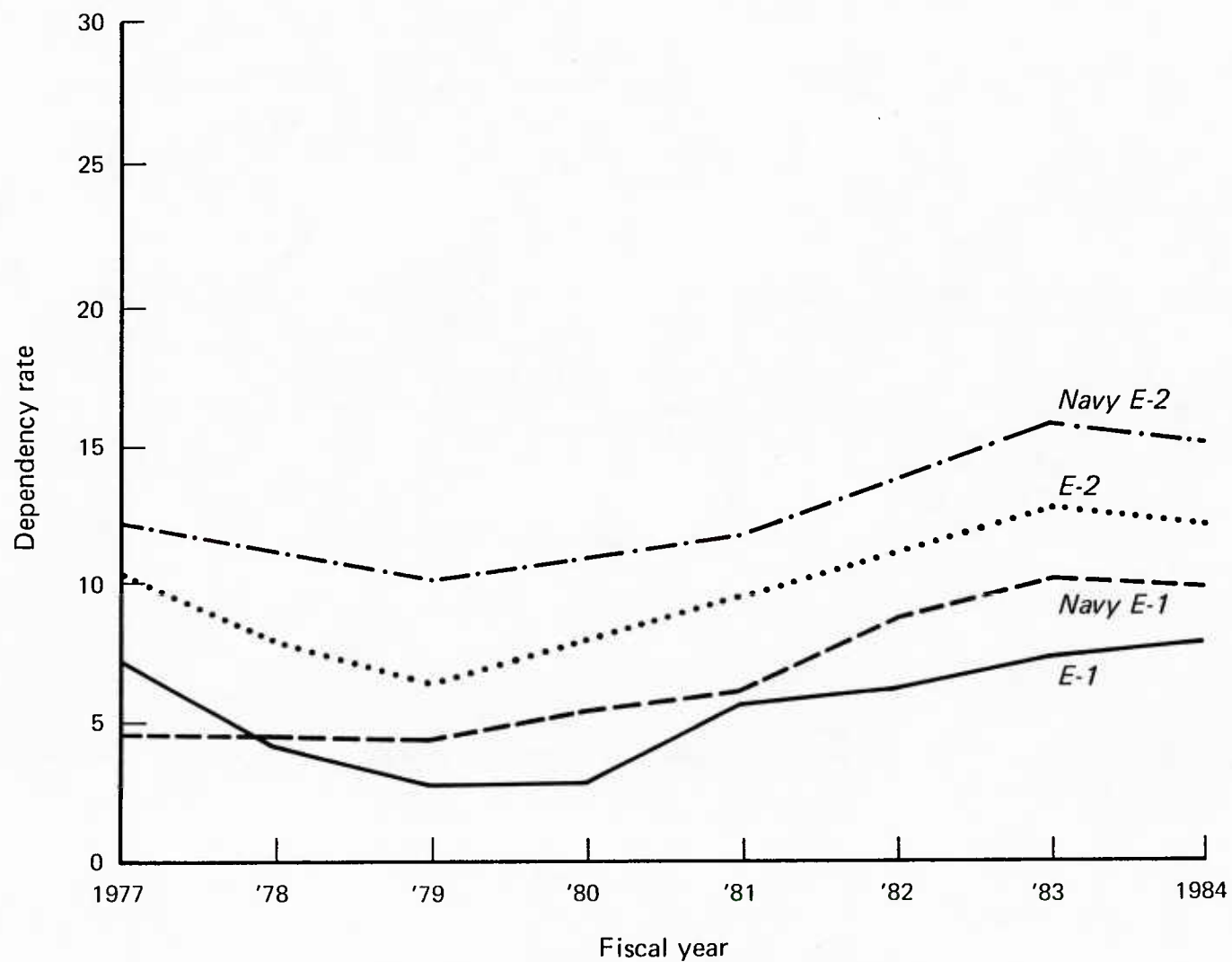
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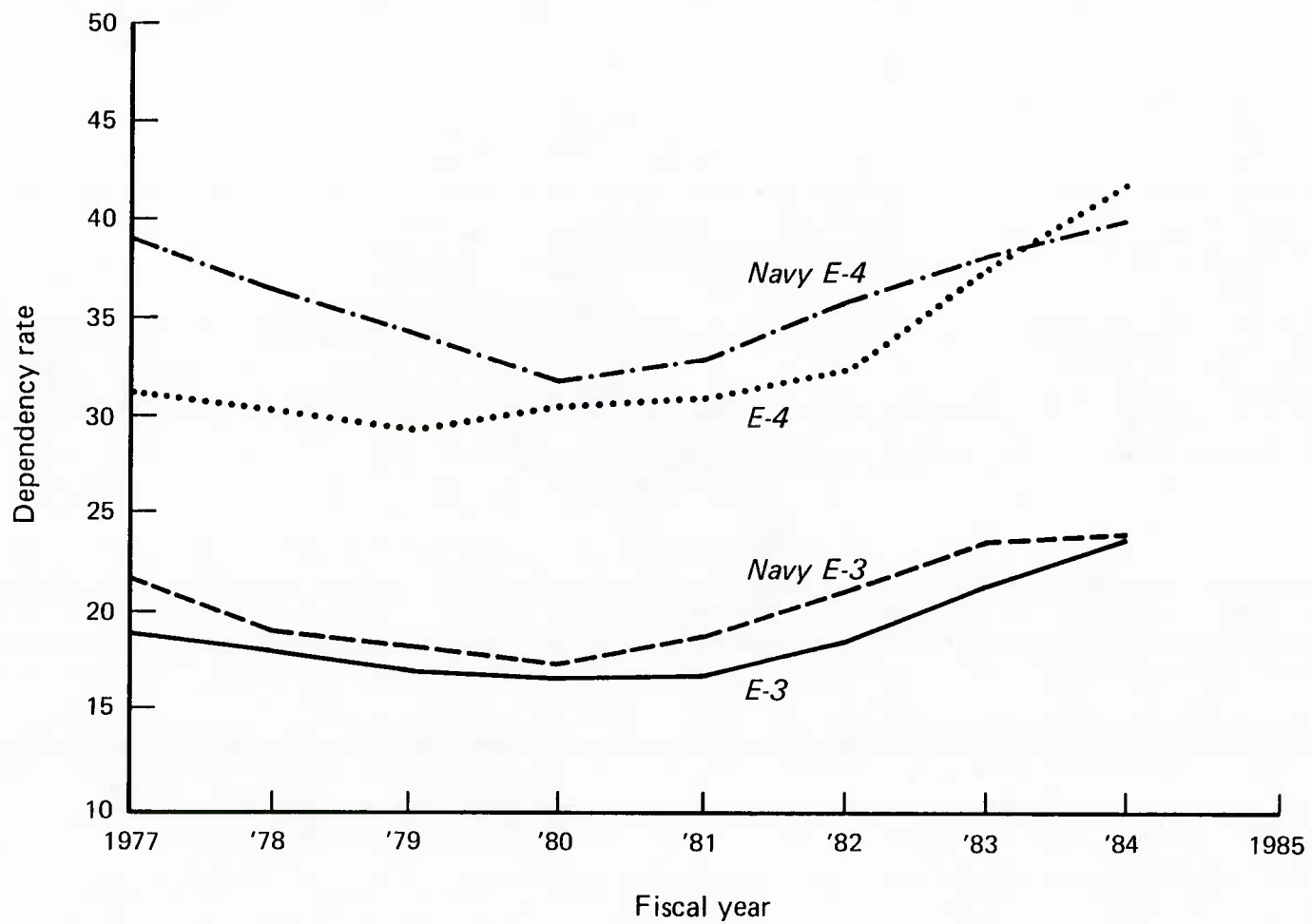
FIG. 7: DEPENDENCY RATES FOR MARINE CORPS AND NAVY E-3 AND E-4
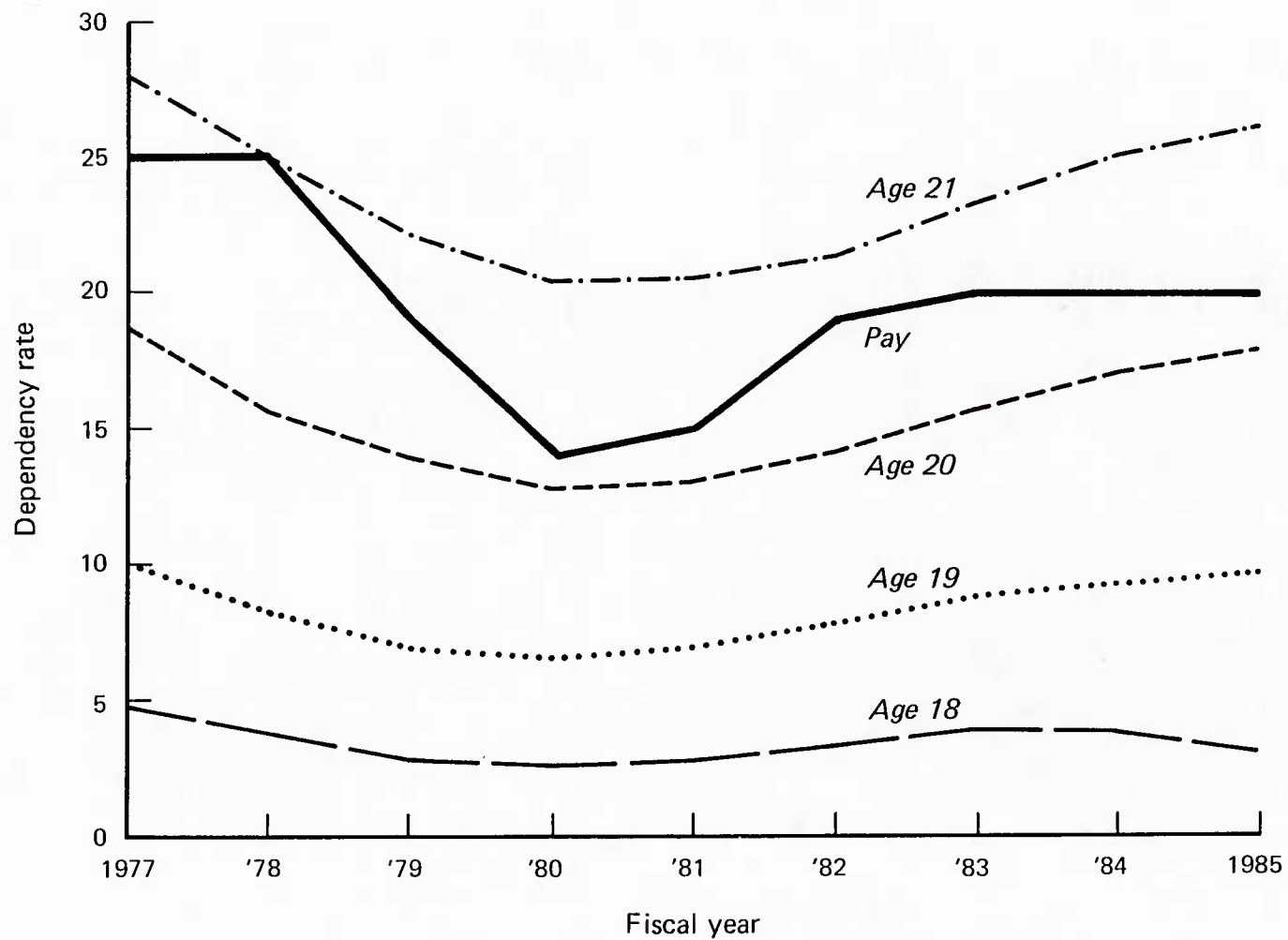
FIG. 8: MILITARY PAY INDEX AND DEPENDENCY RATES FOR ENLISTED MARINES AGE 18 TO 21

time frame might correlate with dependency without the existence of a cause-and-effect relationship. But, for a number of reasons, the effect of pay on dependency seems plausible. First, an individual's present and expected future earnings will influence his or her decision to get married. Higher earnings are likely to increase the probability of marriage because a family will be more affordable. The severe income erosion suffered by military members in 1979 to 1981 must have caused some Marines to seriously consider whether they could afford to have a family, and many would decide to delay marriage. As military incomes rise, marriage rates will probably return to approximately their former levels for each age group.

Moreover, economic studies have found that marriage rates are positively correlated with the business cycle.[1] That is, as incomes rise above their trend values, more people get married. Members of the military are not directly influenced by the U.S. business climate, but the uncertainties of budget appropriations sometimes have a similar effect on the services. The fluctuations in military pay since the mid-1970s have affected marital status among Marines in a pattern consistent with that previously observed for civilians.

STATISTICAL ANALYSIS

The relationship between pay and dependency was investigated through correlation and regression techniques. As would be expected from examining figure 8, the simple correlation between pay and dependency is high within each age group, ranging from 0.72 to 0.83 for those under age 26. For Marines over age 26 the correlation is lower, since a larger percentage of this group already has dependents and the rates will therefore not be as sensitive to income fluctuations. For Marines over age 28, there is no significant correlation between pay and the dependency rate.

The effect of pay on dependency can be estimated directly by regression analysis. Two procedures were used to develop estimates. The first was to estimate the effect of pay on dependency for each age separately, using the nine annual observations available. The second was to pool the observations for all ages, inserting dummy variables to control for variations in average

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1. See, for example, Morris Silver, "Births, Marriages, and Business Cycles in the United States," *Journal of Political Economy* 73 (April 1965): 237-255.

dependency for different ages. The two procedures yielded similar results; thus, only the results using the first approach are reported here.

The following regression equation is used:

$$\text{Dependency rate} = a_0 + a_1 \text{ pay index}.$$

The regression results are reported in table 2.[1] Up to the age of 28, the effect of pay is statistically significant. The results are summarized in tables 3 and 4, which show the predicted dependency rate by age for different values of the pay index. If the pay index were to rise from 1.00 to 1.02, for example, the dependency rate for 22-year-old Marines is predicted to increase by 1.4 points, from 33.4 to 34.8.

In making projections, it is important to remember that the pay index is in real dollars – that is, adjusted for inflation – and uses fiscal 1984 as the base year. For example, if Basic Military Compensation (BMC) for FY 1986 is expected to be 10 percent higher than in 1984, but the Consumer Price Index (CPI) is 8 percent higher, a 2 percent rise in the pay index results. A 10 percent rise in BMC coupled with a 12 percent increase in the CPI will result in a 2 percent drop in the pay index, from 1.00 to 0.98. (Using 100 as the 1984 price index, the pay index is given by 110 divided by 112, or 0.982.)

Incorporating pay changes is only the first step in estimating future dependency rates. The adjustment procedure only predicts changes in dependency for each age group. To calculate the aggregate Marine Corps dependency rate, data on the age distribution of the enlisted force is needed. The calculation can be done in several ways. If the actual number of Marines of each age is known, this number is multiplied by the projected dependency rate for each age provided in tables 3 and 4 (divided by 100 to put in fractional form). The product is the expected number of Marines of each age qualifying for the higher Basic Allowance for Quarters (BAQ). For budgetary purposes, each pay grade should be calculated separately, since the amount of BAQ increases with rank.

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1. The data used in the analysis are provided in appendix A.

TABLE 2

REGRESSION COEFFICIENTS FOR THE EFFECT OF PAY ON
DEPENDENCY RATES BY AGE

Age	Intercept	Pay index coefficient	R^2
17	− 0.089 (1.4)[a]	0.106 (1.7)	0.298
18	− 0.127 (2.7)	0.162 (3.5)	0.635
19	− 0.154 (1.5)	0.240 (2.3)	0.439
20	− 0.267 (1.6)	0.427 (2.6)	0.485
21	− 0.356 (2.1)	0.597 (3.6)	0.646
22	− 0.351 (1.9)	0.685 (3.8)	0.671
23	− 0.225 (1.3)	0.670 (3.9)	0.686
24	− 0.085 (0.5)	0.632 (3.7)	0.662
25	− 0.050 (0.3)	0.680 (3.4)	0.624
26	0.070 (0.4)	0.625 (3.6)	0.644
27	0.263 (1.5)	0.482 (2.8)	0.530
28	0.411 (2.1)	0.377 (1.9)	0.336

Note: All regressions contain nine observations.

a. Absolute value of t-statistics in parentheses.

TABLE 3

PREDICTED DEPENDENCY RATES BY PAY INDEX AND AGE
(percent)

Age	Pay index (1984 = 1.00)						
	0.94	0.96	0.98	1.00	1.02	1.04	1.06
17	1.1	1.3	1.6	1.8	2.0	2.2	2.4
18	2.5	2.9	3.2	3.5	3.8	4.2	4.5
19	7.2	7.7	8.2	8.7	9.1	9.6	10.1
20	13.4	14.3	15.1	16.0	16.9	17.7	18.6
21	20.5	21.7	22.9	24.1	25.3	26.5	27.7
22	29.3	30.7	32.0	33.4	34.8	36.1	37.5
23	40.4	41.8	43.1	44.5	45.8	47.1	48.5
24	50.9	52.1	53.4	54.7	55.9	57.2	58.5
25	58.9	60.3	61.6	63.0	64.3	65.7	67.0
26	65.8	67.1	68.3	69.6	70.9	72.1	73.4
27	71.6	72.6	73.6	74.5	75.5	76.5	77.4
28	76.5	77.2	78.0	78.7	79.5	80.2	81.0

TABLE 4

AVERAGE DEPENDENCY RATES[a]

Age	Dependency rate	Age	Dependency rate
29	82.1	40	95.3
30	85.8	41	95.5
31	88.8	42	95.5
32	90.9	43	95.4
33	92.3	44	95.6
34	93.4	45	95.5
35	94.4	46	95.2
36	94.9	47	95.2
37	95.4	48	94.6
38	95.5	49	95.1
39	95.2	50	94.1

a. These rates are the average dependency rates for FY 1977-1984. Dependency rates for these ages are not correlated with pay.

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PROJECTIONS

In the last 2 years, the military pay index has not changed. Because of this, the rise in the dependency rate for each age should level off, as it is already beginning to do. (One possible reason that dependency rates have not yet levelled off despite the lack of change in pay is that there is a lag between pay and its effect on behavior. The analysis was unable to prove this statistically, however.)

The overall Marine Corps dependency rate should continue to rise a few points, however, because of the continued aging of the enlisted force. The high reenlistment rates of the past 3 years "lock in" higher dependency rates, because the pool of reenlisted older Marines will remain in the service for at least 3 years. High reenlistment rates raise the aggregate dependency rate in two ways. First, those Marines currently in the service will grow older and, therefore, will have much higher rates of dependency. Second, fewer new recruits will be required, and new recruits are primarily in the low-dependency age category (17-19). This effect is already being observed, and planned accessions have been revised downwards accordingly.

The importance of changes in the age distribution cannot be stressed too strongly. Figure 9 shows the average dependency rates for Marines age 17 to 25 during the last 8 fiscal years. Relatively small differences in age have a large impact on the dependency rate. For example, the rate for 23-year-old Marines is 11.2 percentage points higher than that for 22-year-olds. Of course, if the age distribution remains constant, dependency rates will not change. However, the average age of Marines has been increasing since 1977. Figure 10 shows the pronounced upward trend in average age for the most populous pay grades. There is no evidence that the trend has reached its peak, and high reenlistment rates will continue to push up the average age of Marines in these three grades.

Predicting the future age distribution of the enlisted force is necessarily imprecise because of limitations in the data now available. Ideally, the current force would be examined with special emphasis on age and remaining contract obligations. Using predicted reenlistment rates, it would then be possible to project the age distribution for the next few years.
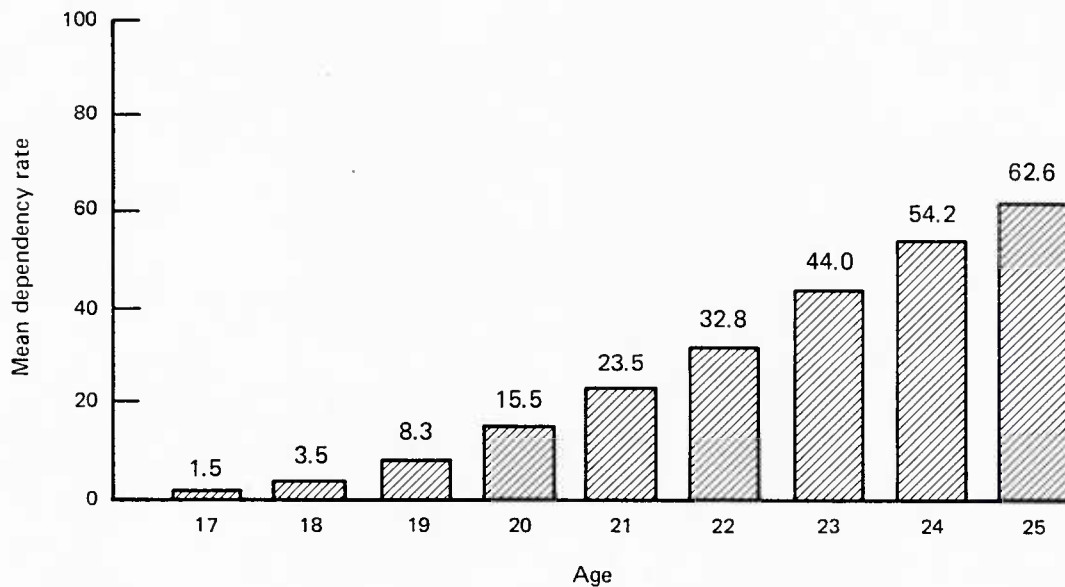
FIG. 9: AVERAGE DEPENDENCY RATES BY AGE

Estimates of dependency rates for 1986 through 1988 are provided in table 5. These estimates are based on the assumption that recent trends will continue. Specifically, the following important assumptions are made:

- The military pay index will remain unchanged.

- The average age in pay grades E-1 and E-2 will remain unchanged.

- For pay grades E-3 through E-5, the average age will rise at the same rates experienced during the last 2 fiscal years, reaching a maximum in FY 1987.

- The average age in pay grades E-6 through E-9 will remain unchanged.

The projections in table 5 are based on the most recent dependency rates and are adjusted for the effect of average age on dependency rates for each
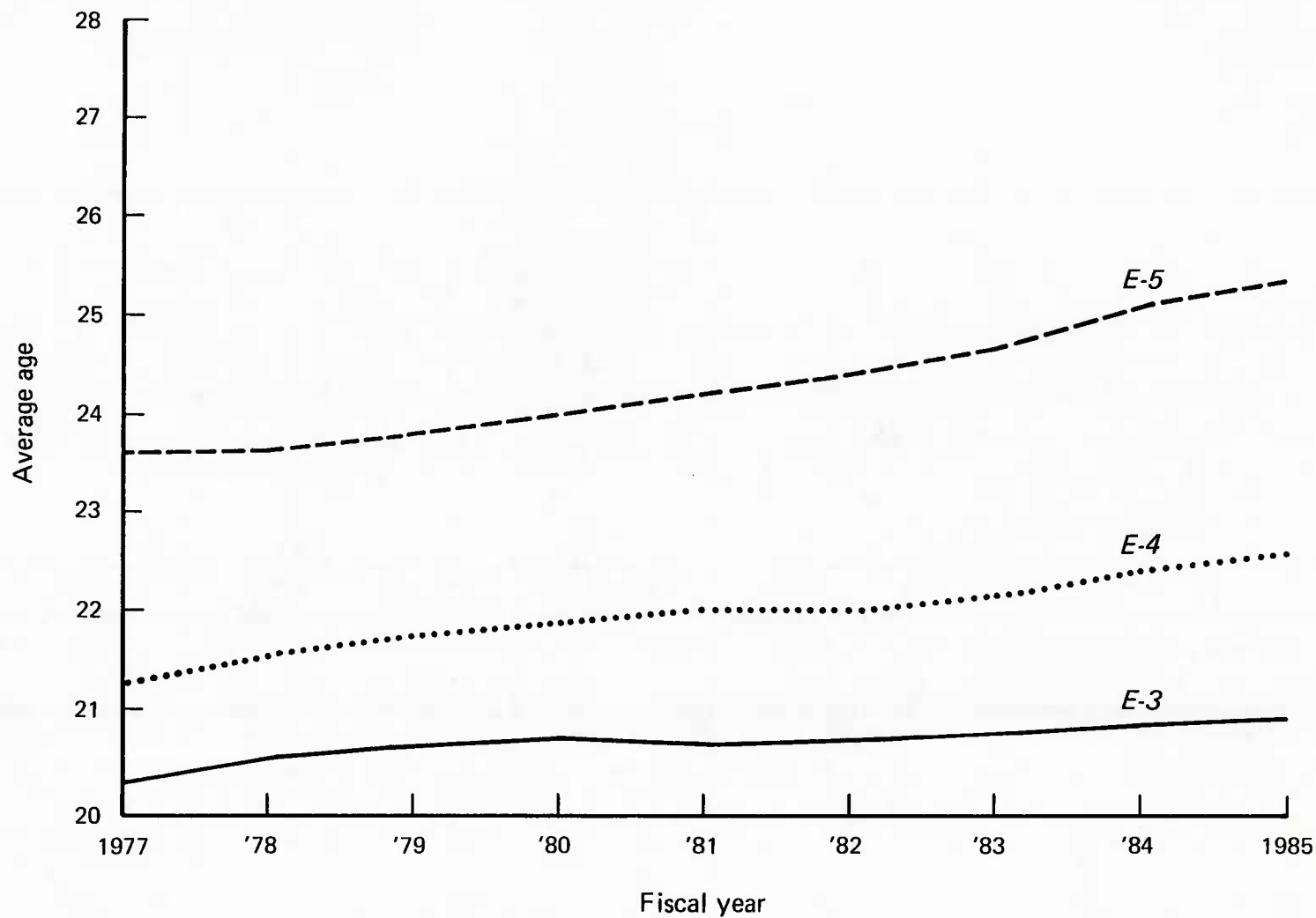
FIG. 10: AVERAGE AGE OF ENLISTED MARINES BY PAY GRADE

grade.[1] The predictions are subject to some error from statistical variation and are particularly sensitive to the assumptions made about pay changes and the future age structure of the enlisted force. Thus, the estimates should be regularly updated, based on the most recent information available on those variables.

TABLE 5

PREDICTED DEPENDENCY RATES FOR 1986-1988
BY PAY GRADE
(percent)

Pay grade	1985[a] dependency rate	Predicted dependency rate		
		1986	1987	1988
E-1	6.8	6.8	6.8	6.8
E-2	12.4	12.4	12.4	12.4
E-3	23.7	24.3	24.9	24.9
E-4	41.8	43.8	45.8	45.8
E-5	69.0	70.9	72.7	72.7
E-6	88.1	88.1	88.1	88.1
E-7	94.8	94.8	94.8	94.8
E-8	97.1	97.1	97.1	97.1
E-9	97.1	97.1	97.1	97.1

a. Actual dependency rate for December 1984.

Further research can develop more accurate predictions by defining the groups studied more narrowly. This analysis concentrated on age as the unit to be studied, but age groups could be broken down further to look at race, sex, mental group, or educational attainment. For example, there are differences in dependency rates among high school diploma graduates (HSDG), non-graduates (NHSG), and those with graduate equivalency diplomas (GED). Figure 11 shows average dependency rates by educational status. High school graduates have significantly lower dependency rates than the other two groups during the critical younger years. This fact is consistent with previous findings of the effect of education on marriage rates. More importantly, the increasing proportion of Marine recruits who are high school graduates has made the aggregate dependency rate lower than it otherwise would have been.

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1. The procedures used to adjust the rates for changes in average age are described in appendix B.
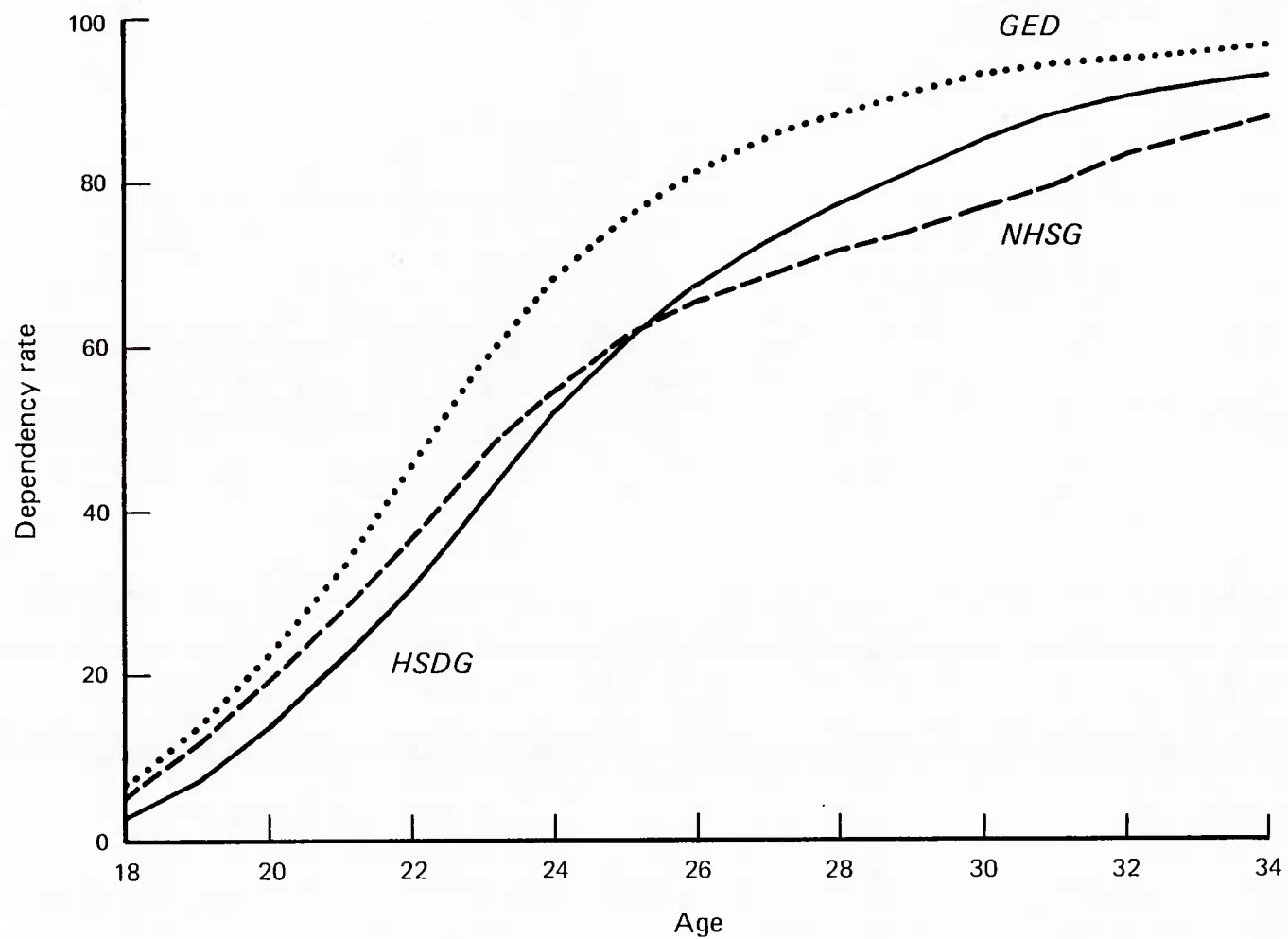
FIG. 11: MEAN DEPENDENCY RATE BY LEVEL OF EDUCATION AND AGE

APPENDIX A

DATA

TABLE A-1

DEPENDENCY RATES BY AGE

AGE	FISCAL YEAR								
	1977	1978	1979	1980	1981	1982	1983	1984	1985
17	2.14	2.04	0.81	0.77	1.22	1.65	2.08	1.03	1.95
18	4.85	3.83	2.80	2.63	2.77	3.45	3.96	3.87	3.07
19	9.97	8.30	7.02	6.62	7.00	7.93	8.89	9.39	9.68
20	18.70	15.59	13.91	12.78	13.15	14.19	15.79	17.14	17.90
21	27.97	25.08	22.07	20.42	20.53	21.26	23.37	25.07	26.14
22	38.34	34.45	31.83	29.33	29.52	29.94	32.39	34.30	35.37
23	49.49	46.23	42.93	41.17	40.58	41.12	42.71	45.06	46.39
24	60.51	56.18	54.35	51.94	51.14	51.12	53.08	54.19	55.57
25	69.67	65.67	61.81	60.42	59.86	58.70	60.36	63.19	63.36
26	74.39	73.18	69.63	66.99	66.47	65.74	66.67	68.74	70.68
27	78.78	77.53	75.54	73.18	71.63	71.39	71.74	74.05	74.63
28	82.78	81.34	79.37	78.64	76.25	75.20	75.98	77.66	79.21

COMPONENTS OF DEPENDENCY RATES AND AVERAGE AGE
BY GRADE AND FISCAL YEAR QUARTER

(PERCENT)

GRADE	DATE	PARENT	CHILD	SPOUSE	DEPENDENCY	AVERAGE AGE
1	7609	0.06	0.49	6.28	6.83	18.93
1	7612	0.04	0.59	6.29	6.92	19.07
1	7703	0.04	0.56	6.83	7.44	19.21
1	7706	0.05	0.54	6.39	6.98	19.04
1	7709	0.04	0.48	5.54	6.07	19.08
1	7712	0.03	0.50	5.11	5.64	19.01
1	7803	0.04	0.52	6.39	6.95	19.17
1	7806	0.04	0.69	4.74	5.46	19.08
1	7809	0.03	0.63	3.54	4.20	19.09
1	7812	0.04	0.69	2.65	3.38	19.09
1	7903	0.03	0.90	2.98	3.91	19.19
1	7906	0.02	0.82	2.83	3.68	19.05
1	7909	0.01	0.72	2.31	3.04	19.04
1	7912	0.02	0.77	2.87	3.66	19.10
1	8003	0.02	1.13	3.16	4.31	19.39
1	8006	0.04	0.95	3.16	4.15	19.27
1	8009	0.03	0.93	2.36	3.32	19.12
1	8012	0.02	0.88	3.50	4.40	19.26
1	8103	0.02	0.94	5.68	6.63	19.51
1	8106	0.01	0.82	5.69	6.52	19.32
1	8109	0.01	0.71	4.94	5.66	19.13
1	8112	0.01	0.68	5.08	5.77	19.27
1	8203	0.04	0.78	6.59	7.41	19.62
1	8206	0.03	0.70	6.43	7.16	19.46
1	8209	0.03	0.50	5.51	6.05	19.22
1	8212	0.02	0.55	6.11	6.68	19.39
1	8303	0.03	0.79	8.06	8.89	19.76
1	8306	0.02	0.74	8.02	8.78	19.68
1	8309	0.04	0.41	6.42	6.87	19.25
1	8312	0.03	0.48	6.30	6.81	19.36
1	8403	0.03	0.63	7.88	8.54	19.72
1	8406	0.06	0.78	7.77	8.60	19.62
1	8409	0.07	0.63	6.58	7.28	19.22
1	8412	0.07	0.61	6.10	6.78	19.29

GRADE	DATE	PARENT	CHILD	SPOUSE	DEPENDENCY	AVERAGE AGE
2	7609	0.07	0.63	11.12	11.83	19.53
2	7612	0.08	0.62	9.99	10.69	19.52
2	7703	0.09	0.59	9.88	10.56	19.49
2	7706	0.09	0.55	9.87	10.51	19.54
2	7709	0.08	0.53	9.11	9.72	19.65
2	7712	0.06	0.76	8.38	9.20	19.59
2	7803	0.07	0.67	8.52	9.26	19.54
2	7806	0.05	0.70	8.50	9.26	19.56
2	7809	0.05	0.71	7.34	8.10	19.66
2	7812	0.08	0.82	6.95	7.85	19.60
2	7903	0.07	0.84	6.57	7.48	19.57
2	7906	0.06	0.93	6.27	7.26	19.59
2	7909	0.05	0.96	5.68	6.70	19.71
2	7912	0.04	1.06	6.90	8.00	19.69
2	8003	0.07	0.99	6.94	8.00	19.62
2	8006	0.07	0.97	6.78	7.82	19.67
2	8009	0.05	0.98	7.07	8.11	19.78
2	8012	0.04	1.06	7.35	8.45	19.88
2	8103	0.03	0.97	7.29	8.29	19.75
2	8106	0.02	0.91	7.65	8.59	19.75
2	8109	0.05	0.93	8.65	9.62	19.86
2	8112	0.07	0.90	9.14	10.11	19.91
2	8203	0.06	0.75	8.87	9.68	19.75
2	8206	0.06	0.77	9.02	9.85	19.79
2	8209	0.08	0.78	10.12	10.98	19.87
2	8212	0.06	0.87	10.35	11.29	19.90
2	8303	0.04	0.72	10.40	11.15	19.86
2	8306	0.06	0.59	10.72	11.37	19.90
2	8309	0.06	0.67	11.78	12.51	19.98
2	8312	0.03	0.75	11.98	12.80	20.04
2	8403	0.15	0.73	11.19	12.07	19.88
2	8406	0.12	0.77	10.69	11.58	19.86
2	8409	0.12	0.82	11.17	12.12	19.90
2	8412	0.13	0.74	11.54	12.42	19.93

GRADE	DATE	PARENT	CHILD	SPOUSE	DEPENDENCY	AVERAGE AGE
3	7609	0.13	0.81	18.40	19.34	20.25
3	7612	0.14	0.75	18.01	18.90	20.27
3	7703	0.12	0.73	18.37	19.22	20.30
3	7706	0.14	0.74	18.35	19.23	20.33
3	7709	0.13	0.76	18.38	19.27	20.61
3	7712	0.15	0.89	16.74	17.78	20.45
3	7803	0.14	0.92	17.45	18.51	20.51
3	7806	0.15	0.92	17.22	18.28	20.53
3	7809	0.15	0.92	17.21	18.28	20.80
3	7812	0.14	0.92	16.76	17.82	20.61
3	7903	0.17	0.97	16.33	17.46	20.64
3	7906	0.17	1.03	16.04	17.24	20.64
3	7909	0.17	1.04	16.02	17.24	20.92
3	7912	0.14	1.09	15.30	16.53	20.68
3	8003	0.14	1.20	15.28	16.61	20.67
3	8006	0.13	1.17	15.46	16.76	20.68
3	8009	0.14	1.23	15.66	17.03	20.71
3	8012	0.14	1.31	15.10	16.54	20.69
3	8103	0.16	1.36	15.02	16.54	20.71
3	8106	0.16	1.41	15.25	16.81	20.73
3	8109	0.16	1.44	15.46	17.07	20.76
3	8112	0.16	1.36	15.16	16.68	20.72
3	8203	0.17	1.31	15.78	17.25	20.74
3	8206	0.18	1.22	16.71	18.11	20.77
3	8209	0.21	1.19	17.48	18.88	20.78
3	8212	0.24	1.12	18.17	19.53	20.82
3	8303	0.20	1.11	18.90	20.21	20.85
3	8306	0.21	1.08	19.56	20.85	20.85
3	8309	0.23	1.07	20.25	21.56	20.85
3	8312	0.23	1.03	20.49	21.75	20.89
3	8403	0.28	1.06	21.19	22.52	20.93
3	8406	0.29	1.10	21.66	23.05	20.94
3	8409	0.30	1.12	22.42	23.83	20.98
3	8412	0.28	1.14	22.30	23.71	20.96

GRADE	DATE	PARENT	CHILD	SPOUSE	DEPENDENCY	AVERAGE AGE
4	7609	0.24	1.32	31.26	32.81	21.29
4	7612	0.22	1.36	29.95	31.53	21.28
4	7703	0.22	1.15	30.04	31.41	21.26
4	7706	0.23	1.18	29.98	31.39	21.31
4	7709	0.23	1.21	30.00	31.43	21.60
4	7712	0.20	1.39	27.97	29.56	21.45
4	7803	0.21	1.33	28.31	29.85	21.53
4	7806	0.20	1.34	28.85	30.39	21.60
4	7809	0.20	1.35	28.90	30.44	21.89
4	7812	0.22	1.28	28.93	30.43	21.73
4	7903	0.20	1.24	28.13	29.57	21.72
4	7906	0.21	1.36	27.81	29.37	21.73
4	7909	0.20	1.39	27.90	29.49	22.02
4	7912	0.22	1.34	27.90	29.47	21.79
4	8003	0.20	1.41	27.62	29.22	21.79
4	8006	0.20	1.51	28.02	29.72	21.87
4	8009	0.21	1.64	28.83	30.68	22.01
4	8012	0.24	1.78	28.46	30.48	21.99
4	8103	0.21	1.96	27.93	30.10	21.97
4	8106	0.24	2.11	27.78	30.12	21.99
4	8109	0.26	2.21	28.75	31.22	22.11
4	8112	0.26	2.21	27.65	30.12	22.01
4	8203	0.25	2.23	27.43	29.91	21.99
4	8206	0.25	2.25	28.47	30.97	22.04
4	8209	0.27	2.29	29.99	32.55	22.13
4	8212	0.29	2.23	31.02	33.54	22.18
4	8303	0.30	2.19	31.92	34.41	22.23
4	8306	0.29	2.24	33.59	36.12	22.28
4	8309	0.26	2.19	35.58	38.03	22.39
4	8312	0.29	2.13	36.72	39.13	22.45
4	8403	0.31	2.07	37.57	39.95	22.50
4	8406	0.30	2.06	38.11	40.48	22.51
4	8409	0.23	2.19	39.68	42.15	22.61
4	8412	0.30	2.19	39.34	41.83	22.60

GRADE	DATE	PARENT	CHILD	SPOUSE	DEPENDENCY	AVERAGE AGE
5	7609	0.23	2.61	59.19	62.03	23.61
5	7612	0.22	2.61	58.86	61.69	23.63
5	7703	0.22	2.18	58.55	60.95	23.52
5	7706	0.24	2.35	58.26	60.85	23.52
5	7709	0.24	2.35	58.21	60.80	23.79
5	7712	0.25	2.95	55.66	58.85	23.57
5	7803	0.28	2.67	55.44	58.39	23.51
5	7806	0.28	2.67	56.17	59.12	23.58
5	7809	0.23	2.68	56.03	58.99	23.86
5	7812	0.24	2.60	55.90	58.74	23.71
5	7903	0.24	2.62	56.13	58.99	23.79
5	7906	0.26	2.54	55.74	58.54	23.80
5	7909	0.26	2.56	55.73	58.55	24.08
5	7912	0.23	2.76	56.96	59.96	23.98
5	8003	0.21	2.75	56.13	59.09	23.98
5	8006	0.24	2.78	54.97	57.98	23.97
5	8009	0.21	3.02	56.86	60.09	24.15
5	9012	0.22	2.94	56.44	59.61	24.20
3	8103	0.25	3.10	55.90	59.25	24.22
5	8106	0.24	3.26	55.80	59.31	24.25
5	8109	0.25	3.44	57.06	60.75	24.44
5	8112	0.25	3.71	56.35	60.31	24.45
5	8203	0.23	4.05	55.38	59.66	24.45
5	8206	0.25	3.95	54.66	58.86	24.41
5	8209	0.26	4.11	56.98	61.35	24.58
5	8212	0.25	4.12	57.53	61.89	24.65
5	9303	0.23	4.23	57.97	62.43	24.74
5	8306	0.24	4.25	57.89	62.37	24.76
5	8309	0.20	4.33	60.49	65.02	24.97
5	9312	0.22	4.39	61.34	65.95	25.11
5	8403	0.22	4.48	62.24	66.94	25.23
5	9406	0.23	4.51	62.57	67.31	25.29
5	9409	0.25	4.44	63.83	68.52	25.42
5	8412	0.23	4.52	64.27	69.03	25.45

GRADE	DATE	PARENT	CHILD	SPOUSE	DEPENDENCY	AVERAGE AGE
6	7609	0.22	4.26	82.99	87.47	27.92
6	7612	0.22	4.38	83.26	87.87	28.07
6	7703	0.23	4.35	83.15	87.73	27.87
6	7706	0.23	4.39	83.51	88.13	27.90
6	7709	0.23	4.39	83.46	88.08	28.18
6	7712	0.21	5.18	81.81	87.20	27.99
6	7803	0.22	4.97	82.21	87.40	27.95
6	7806	0.22	5.06	82.28	87.56	28.01
6	7809	0.22	5.06	82.26	87.54	28.28
6	7812	0.25	4.99	81.29	86.52	27.87
6	7903	0.22	5.20	81.76	87.19	28.10
6	7906	0.22	5.40	81.57	87.19	28.25
6	7909	0.22	5.41	81.46	87.09	28.53
6	7912	0.21	5.37	82.02	87.61	28.52
6	8003	0.20	5.57	81.71	87.48	28.51
6	8006	0.21	5.58	81.93	87.71	28.61
6	8009	0.19	5.66	81.72	87.56	28.61
6	8012	0.18	5.83	81.56	87.58	28.70
6	8103	0.16	6.05	81.33	87.53	28.70
6	8106	0.17	6.31	81.47	87.95	28.83
6	8109	0.14	6.48	81.37	87.99	28.97
6	8112	0.16	6.39	80.24	86.79	28.64
6	8203	0.15	6.57	80.32	87.04	28.74
6	8206	0.14	6.56	79.71	86.40	28.63
6	8209	0.15	6.57	79.71	86.44	28.72
6	8212	0.13	6.62	79.51	86.25	28.75
6	8303	0.14	6.72	79.54	86.39	28.85
6	8306	0.14	6.66	80.02	86.82	28.85
6	8309	0.15	6.76	80.51	87.41	29.02
6	8312	0.15	6.49	80.64	87.28	29.09
6	8403	0.14	6.40	80.89	87.42	29.10
6	8406	0.18	6.40	81.36	87.94	29.27
6	8409	0.16	6.54	81.53	88.23	29.38
6	8412	0.18	6.57	81.32	88.07	29.44

GRADE	DATE	PARENT	CHILD	SPOUSE	DEPENDENCY	AVERAGE AGE
7	7609	0.22	5.07	88.76	94.05	34.25
7	7612	0.21	5.15	88.74	94.10	34.14
7	7703	0.15	5.29	88.94	94.38	34.06
7	7706	0.24	5.01	89.03	94.28	34.10
7	7709	0.24	5.00	89.02	94.26	34.37
7	7712	0.25	6.13	87.99	94.36	33.82
7	7803	0.22	5.97	88.54	94.73	33.78
7	7806	0.24	5.86	88.86	94.97	33.78
7	7809	0.24	5.85	88.87	94.96	34.06
7	7812	0.18	6.00	88.80	94.98	33.59
7	7903	0.15	5.99	88.86	95.00	33.71
7	7906	0.13	5.91	88.87	94.91	33.64
7	7909	0.13	5.90	88.86	94.88	33.92
7	7912	0.10	5.94	88.65	94.68	33.65
7	8003	0.10	6.04	88.45	94.58	33.68
7	8006	0.10	6.23	88.14	94.47	33.79
7	8009	0.12	6.20	87.94	94.25	33.81
7	8012	0.12	6.19	88.09	94.40	33.70
7	8103	0.13	6.50	87.87	94.51	33.67
7	8106	0.13	6.98	87.41	94.52	33.72
7	8109	0.12	6.87	87.47	94.45	33.79
7	8112	0.12	6.88	87.17	94.17	33.56
7	8203	0.15	7.15	86.93	94.23	33.44
7	8206	0.17	7.25	86.93	94.35	33.54
7	8209	0.16	7.23	86.99	94.37	33.65
7	8212	0.17	7.42	86.89	94.48	33.58
7	8303	0.18	7.47	86.99	94.64	33.60
7	8306	0.15	7.54	86.98	94.67	33.59
7	8309	0.17	7.51	87.10	94.77	33.73
7	8312	0.14	7.75	36.85	94.74	33.73
7	8403	0.14	7.87	86.76	94.77	33.81
7	8406	0.15	7.87	86.82	94.84	33.94
7	8409	0.17	7.84	86.93	94.94	33.98
7	8412	0.17	7.77	86.91	94.85	33.98

GRADE	DATE	PARENT	CHILD	SPOUSE	DEPENDENCY	AVERAGE AGE
8	7609	0.06	5.00	89.73	94.79	38.32
8	7612	0.06	5.20	89.72	94.98	38.42
8	7703	0.06	4.81	91.01	95.88	38.42
8	7706	0.03	4.64	91.41	96.08	38.44
8	7709	0.03	4.64	31.41	96.08	38.73
8	7712	0.06	5.69	89.89	95.64	38.54
8	7803	0.06	5.16	90.41	95.63	38.55
8	7806	0.06	5.09	90.61	95.77	38.67
8	7809	0.06	5.09	90.62	95.77	38.96
8	7812	0.15	5.50	90.36	96.00	38.66
8	7903	0.15	5.69	90.34	96.18	38.72
9	7906	0.15	5.68	90.43	96.26	38.70
8	7909	0.15	5.66	90.47	96.28	38.97
8	7912	0.25	5.64	90.47	96.36	38.64
8	8003	0.26	6.08	90.18	96.52	38.74
8	8006	0.27	6.01	90.35	96.63	38.80
8	8009	0.18	6.14	89.81	96.12	38.95
8	8012	0.17	5.91	90.35	96.43	38.82
8	8103	0.16	6.01	90.34	96.52	38.83
9	8106	0.16	5.82	90.71	96.70	38.92
8	8109	0.17	5.65	90.89	96.71	39.01
8	8112	0.15	6.02	90.40	96.57	38.67
8	8203	0.15	6.19	90.55	96.89	38.63
8	8206	0.12	6.51	90.23	96.86	38.69
8	8209	0.09	6.67	89.82	96.58	38.80
8	8212	0.11	7.13	89.24	96.49	38.62
8	8303	0.11	7.37	88.90	96.38	38.65
8	8306	0.13	7.32	89.27	96.72	38.53
8	8309	0.13	7.01	89.85	97.00	38.65
8	8312	0.19	7.04	89.89	97.12	38.59
8	8403	0.16	6.81	90.03	96.99	38.55
8	8406	0.11	6.76	90.05	96.92	38.64
8	8409	0.11	6.72	90.30	97.12	38.65
8	8412	0.11	7.02	89.97	97.10	38.61

GRADE	DATE	PARENT	CHILD	SPOUSE	DEPENDENCY	AVERAGE AGE
9	7609	0.24	4.55	90.42	95.21	43.77
9	7612	0.08	4.58	90.27	94.94	43.77
9	7703	0.16	4.54	91.00	95.71	43.79
9	7706	0.24	4.64	91.12	96.00	43.88
9	7709	0.24	4.64	91.12	96.00	44.14
9	7712	0.16	5.47	90.67	96.30	43.82
9	7803	0.16	5.52	90.79	96.48	43.82
9	7806	0.16	5.69	90.77	96.62	43.89
9	7809	0.16	5.68	90.77	96.62	44.15
9	7812	0.24	5.49	91.49	97.22	43.70
9	7903	0.24	5.58	90.95	96.77	43.68
9	7906	0.24	5.64	90.90	96.78	43.74
9	7909	0.24	5.61	90.94	96.79	43.99
9	7912	0.16	5.66	90.09	95.91	43.66
9	8003	0.08	5.82	90.23	96.12	43.85
9	8006	0.24	5.62	89.98	95.85	43.91
9	8009	0.25	5.64	90.69	96.57	43.89
9	8012	0.25	5.83	90.25	96.33	43.95
9	8103	0.25	6.21	89.45	95.91	43.98
9	8106	0.25	5.66	89.83	95.73	44.13
9	8109	0.25	6.01	89.74	96.00	44.23
9	8112	0.24	6.18	89.40	95.82	44.17
9	8203	0.24	6.46	89.42	96.12	44.23
9	8206	0.33	6.75	89.10	96.18	44.21
9	8209	0.32	6.69	89.61	96.62	44.32
9	8212	0.24	6.81	89.70	96.75	44.39
9	8303	0.32	5.79	90.35	96.46	44.48
9	8306	0.32	5.52	90.94	96.77	44.50
9	8309	0.32	4.97	91.42	96.71	44.47
9	8312	0.32	5.24	91.35	96.90	44.50
9	8403	0.31	5.44	91.18	96.93	44.35
9	8406	0.31	5.24	91.47	97.03	44.37
9	8409	0.24	5.05	91.40	96.69	44.35
9	8412	0.23	5.65	91.19	97.06	44.14

TABLE A-3

PAY INDEX[a]

Fiscal year	Pay index (1984 = 1.00)
1977	1.049
1978	1.049
1979	0.989
1980	0.936
1981	0.947
1982	0.992
1983	1.004
1984	1.000
1985	1.000

a. Computed from Base Pay and Basic Allowance for Quarters for a Marine with dependents. Index is assumed to move proportionally for all grades.

APPENDIX B

EFFECT OF AGE ON DEPENDENCY RATES

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The predicted dependency rates by pay grade shown in table 5 of the main text are based on two major assumptions. First, there will be no significant change in the deflated military pay index. Second, the average ages for grades E-3 through E-5 will rise at the annual rates experienced during the last 2 fiscal years until they reach a maximum in 1987.

To estimate the effect of changes in average age, regression analysis was performed on quarterly dependency rates for each pay grade. First, the weighted average age for each grade was calculated for each quarter.[1] Then the quarterly dependency rates were regressed on the military pay index and average age, using the following regression equation:

$$\text{Dependency rate} = a_0 + a_1 \text{ pay index} + a_2 \text{ average age} \qquad \text{(B-1)}$$

The results of the regression analysis are provided in table B-1. Only the results for grades E-1 through E-5 are shown because the coefficients were insignificant for senior noncommissioned officers. The results indicate strong positive effects of both pay and average age on dependency.

To predict dependency rates through FY 1988, the most recent data available (December 1984) were used as base rates and were adjusted for the effect of increases in age. Projected increases in average age were determined by examining changes in the data since December 1982. For the grade of E-1, average age has moved erratically, never moving in the same direction for more than two consecutive quarters. It was concluded that there was insufficient evidence to predict any change in average age; thus, the dependency rate is predicted to remain at its current level. A similar conclusion was reached for grade E-2, in which average age in December 1984 was only 0.03 years higher than 2 years before. Consequently, no change in the dependency rate is expected for this grade.

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1. The data used in this analysis are provided in table A-2.

TABLE B-1

EFFECTS OF PAY AND AVERAGE AGE ON DEPENDENCY RATES

Grade	a_0	a_1	a_2	R^2
E-1	– 1.3722	0.2961	0.0590	0.822
	(10.9)[a]	(8.6)	(10.0)	
E-2	– 1.9277	0.3452	0.0852	0.779
	(9.0)	(8.4)	(8.5)	
E-3	– 2.1341	0.4703	0.0896	0.643
	(6.5)	(6.5)	(6.5)	
E-4	– 2.3678	0.5742	0.0967	0.782
	(9.2)	(6.0)	(10.3)	
E-5	– 0.8425	0.3242	0.0467	0.816
	(6.5)	(5.0)	(11.4)	

a. Absolute value of t-statistics in parentheses.

There has been an upward trend in the age of lance corporals (E-3s); the average age in December 1984 was 20.96 versus 20.82 in December 1982. The annual trend is calculated by subtracting the December 1982 average age from the 1984 estimate and dividing by 2.

(Age for Dec 84 – age for Dec 82)/2 = annual change in average age .

For grade E-3 the calculation is

$$(20.96 - 20.82)/2 = 0.07 .$$

Following the basic assumptions used in the projections, the average age of Marine lance corporals is expected to rise by 0.07 years during the next 2 fiscal years. The effect of this increase in age on dependency is calculated by multiplying the increase in age by the average age coefficient (a_2) estimated

from equation B-1. For grade E-3 this coefficient is 0.0896, so the increase in dependency is

$$(0.07) \times (0.0896) = 0.006 \ .$$

To express this as a percentage, multiply 0.006 by 100. The resulting rise in the dependency rate is therefore 0.6 points, or a rise from 23.7 to 24.3. Another increase of 0.6 points is predicted for 1987, resulting in a dependency rate of 24.9.

The calculations for grade E-4 are similar, except that the effect of age is more pronounced. The estimated annual rise in average age is

$$(22.60 - 22.18)/2 = 0.21 \ .$$

The age coefficient for grade E-4 from table B-1 is 0.0967, giving an increase in dependency of

$$(0.21) \times (0.0967) = 0.02 \ .$$

The dependency rate is expected to rise a full 2 points in each of the next 2 years. The rise for grade E-5 is almost as large, approximately 1.87 points per year. For grade E-6 and above, there is no expected rise in dependency even though the average age is rising, because there is little difference in dependency rates at the relatively high ages found in these grades.